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Evidence for an Electron Nematic Phase Transition in Underdoped Iron Pnictide Superconductors

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High-temperature superconductivity often emerges in the proximity of a symmetry-breaking ground state in strongly interacting electronic materials. In the case of the superconducting iron pnictides, in addition to the antiferromagnetic ground state of the parent compounds, a ubiquitous but small structural distortion breaks the crystal's C_4 rotational symmetry in the underdoped part of the phase diagram. It has been proposed that this structural transition is driven by an electronic nematic order, in which the electronic system spontaneously breaks a rotational symmetry of the original Hamiltonian. Similar ideas have previously been suggested for certain underdoped cuprates, for $\text{Sr}_2\text{Ru}_3\text{O}_7$, and some specific fractional quantum Hall states. Recently, through magnetotransport and direct optical imaging, we have found that in-plane magnetic fields can be used to move the twin boundaries associated with structure domains in single crystals of underdoped $\text{Ba}(\text{Fe}_{1-x}\text{Co}_x)_2\text{As}_2$. In addition, by applying small amount of uniaxial pressure, we have aligned most of the twin domains in the samples, which enables us to probe the intrinsic electronic anisotropy of the symmetry breaking phase. Our observation hints at a strong magnetoelastic coupling and highly anisotropic electronic ground state in this class of materials.